*SYNOPSIS OF THE THESIS*

# ULTRASONIC AND CONDUCTOMETRIC BEHAVIOUR OF SOME SPECIES OF AMINO ACIDS IN CONDENSED PHASE

**FOR THE AWARD OF**

## DOCTOR OF PHILOSOPHY

**IN**

## CHEMISTRY

**TO THE FACULTY OF SCIENCE**

## MANGALORE UNIVERSITY

**BY**

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| **Title of the Thesis** | **: "ULTRASONIC AND CONDUCTOMETRIC BEHAVIOUR OF SOME SPECIES OF AMINO ACIDS IN CONDENSED PHASE"** |
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## Chapter 1

## Introduction:

The introductory chapter is discussed under three sections

Part A : Chemistry and bio chemistry of amino acids

Part B : Science and technology of ultrasonics

Part C : Viscosity studies of electrolyte mixtures

### 1.1 (a) Part A: Chemistry and bio chemistry of amino acids

This is an introductory chapter. Section 1.1(a) gives a brief introduction on the general chemistry of amino acids [1] with a special reference to glycine, volumetric properties and literature of all the electrolytes under study . Amino acids have been quite useful as models [*2*] for understanding the thermodynamic behaviour of peptides and proteins in solution. Volumetric properties and heat capacities of amino acids in different aqua-organic media have been investigated. But, similar investigations in aqueous electrolytes and partial aqueous media, which is a prerequisite for the understanding the behaviour of peptides and proteins in bio fluids are rather scarce [3].Glycine is the simplest and inexpensive, but extensively studied amino acid molecule to represent the protein interactions with various solvents, electrolytes and non electrolytes. The interaction of metal ions with protein part of the biological system has attracted lot of interest [4], among the biologists and chemists. In particular transition metals play a vital role in the enzyme activities.In recent years, experimental investigations and theoretical modelling of bio polymers have provided highly detailed pictures of their structural and dynamic properties [5].

The thermodynamic properties of such systems are hardly amenable to a priori calculations and indeed, most interpretations of the thermodynamic behaviour of proteins are based on the data for simpler model compounds. The latter ,for example amino acids and peptides , have obvious limitations in representing the portions of proteins molecules, but the model compound approach has already provided fundamental key results.

A systematic acoustic work with a series of transition metal salt solutions with glycine along with the application of new hole theory [6] and a comparative study of other theories was not observed. Hence the study of glycine as a model compound for amino acids has been considered to study the ion-solvent interactions with transition metal ions in the salt solutions in partially aqueous solutions (5% , 10% and 20% methanol and acetonitrile ) in a wide range of composition and at different temperature range from 293K to 318 K .

### 1.1 (b) **Part B : Science and technology of ultrasonics**

Section 1.1(b) gives an account of acoustic parameters including theory, instrumentation and applications. A brief explanation about Ultrasonic methods [7] and experimental procedure for the determination of the acoustic parameters, viscosity and density related volumetric parameters are given in this chapter. Liquids, liquid mixtures (multi component) [8] and solutions have found wide applications in chemical, textile, leather and nuclear industries. The study and understanding of thermodynamic and transport properties of liquid mixtures and solutions are more essential for their application in these

industries. These studies in multi component (binary, ternary mixtures etc.) mixtures and solutions have been carried out by Infrared IR , Raman effect, Nuclear Magnetic Resonance NMR and dielectric methods. Like other methods, the measurement of ultrasonic velocity in the liquid mixtures and solutions has also been found to be an important tool to study the physico- chemical properties of the mixtures and solutions.

### 1.1 (c) **Part C : Viscosity studies of electrolyte mixtures**

Section 1.1 (c) gives an account of volumetric parameters including theory, instrumentation and applications based on Jones-Dole equation. Using Feakin's transition theory [9]the thermodynamic parameters are determined for liquid mixtures. By taking into account the properties of the solvent in the transition state, several structural problems can be analysed.

## Chapter-2 An investigation on the nature of Glycine and Copper Sulphate in aqueous solutions of methanol and acetonitrile at different temperatures using ultrasonic and viscosity studies

This chapter has been discussed under two sections

**Part A**: deals with Acoustic studies of glycine in aqueous and partially aqueous solutions of copper sulphate ($CuSO_4$. $5H_2O$) at 293, 303,313 and 318K.

**Part B:** deals with viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of copper sulphate ($CuSO_4$. $5H_2O$) at 293, 303,313 and 318K.

### 2(a) Part A: Acoustic studies of glycine in aqueous and partially aqueous solutions of copper sulphate ($CuSO_4$. $5H_2O$) at 293, 303,313 and 318K

In this section, the results obtained during the acoustic studies of a mixture of copper sulphate in glycine solutions at various compositions ranging from

(0.005 M to 0.05 M copper sulphate solutions in 0.05 M to 0.45 M glycine solutions ) in water , 5% , 10% , 20% methanol and 5% ,10% , 20% Acetonitrile in the temperature range of 293 K to 318 K have been presented .Various acoustic parameters like acoustic impedance( Z), adiabatic Compressibility ($\beta$), inter molecular free length ($L_f$), relative association ($R_a$ ) , viscous relaxation time ($\tau$), solvation number ($S_n$), absorption coefficient $\left(\alpha/f^2\right)$, rheochor, free volume ($V_f$) ,

surface area per mol (Y), Van der waals constant ‘a’ and 'b' , molecular radius , collision factor , available volume (Va), geometrical volume(B), internal pressure ( $\pi_i$), solubility parameter, cohesive energy density (CED), apparent molar compressibility ($\phi_K^o$), heat of vapourization ($\Delta$Hv) have been computed. Free length theory , Collision factor theory and the recent hole theory were applied for the interpretations .The retainment of solvation behaviour of amino acids in particular glycine with copper sulphate ($Cu^{2+}$) was studied in partially aqueous solutions

( 5% to 20% methanol and 5% to 20% acetonitrile) at different temperatures. The values of apparent molar compressibility, solvation number, internal pressure and intermolecular free length of glycine are well comparable with the literature values.

**2(b)Viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of copper sulphate at different temperatures and compositions**

We report here, the sound velocities and viscosities of a mixture of glycine and copper sulphate in 5.0%, 10.0% and 20% (v/v) aqueous methanol and acetonitrile solutions at 293 K to 318 K, measured with Ultrasonic interferometer and Ostwald’s type viscometer, respectively. From these data, partial molar adiabatic compressibilities at infinite dilution ($\phi_K^o$ ), corresponding transfer compressibilities ($\Delta_{trfr}\phi_K^o$ ) and viscosity B-coefficients have been obtained. Group contributions[10] in amino acids can be calculated from the B-coefficient data and partial molar volume

data. The hydration numbers and interaction coefficients have also been calculated. The transition state theory has been applied to calculate activation parameters of viscous flow of amino acids in aqueous methanol and acetonitrile solutions. These results have been discussed in terms of various interactions operating in these systems.

We have shown ion–amino acid interaction parameters from the volumetric properties of glycine in aqueous and partially aqueous solutions of Copper Sulphate at 293 to 318 K. Limiting partial molar expansibilities $\phi_E^0$ of amino acids in aqueous solutions of Copper Sulphate are calculated from the measured quantities. In the case of glycine, the transfer volume $\Delta V_\phi^o$ values are positive (except at lower concentrations of Copper Sulphate and at lower temperatures), indicating the dominance of charged end groups, $NH_3^+$ and $COO^-$. Also, group contributions are calculated for glycine in presence of aqueous and partially aqueous copper sulphate solutions using $V_\phi^o$ values. This suggests increase in hydrophilic–hydrophobic group interactions with increase of the side-chain length of the amino acids in comparision with other amino acids.

## Chapter -3 An Ultrasonic and viscosity Studies of Glycine and Nickel Sulphate in aqueous solutions of methanol and acetonitrile at different temperatures

This chapter has been discussed under two sections

**Part A**: deals with Acoustic studies of glycine and nickel sulphate ($NiSO_4$. $6H_2O$) at 293, 303,313 and 318K. in aqueous solutions of methanol and acetonitrile

**Part B:** deals with viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of nickel sulphate ($NiSO_4$. $6H_2O$) at 293, 303,313 and 318K.

### 3(a) Acoustic studies of glycine in aqueous and partially aqueous solutions of Nickel sulphate ($NiSO_4$. $6H_2O$) at 293, 303,313 and 318K

In this section, the results obtained during the acoustic studies of a mixture of nickel sulphate in glycine solutions at various compositions ranging from (0.005 M to 0.05 M nickel sulphate solutions in 0.05 M to 0.45 M glycine solutions in water , 5% , 10% , 20% methanol and 5% ,10% , 20% Acetonitrile in the temperature range of 293 K to 318 K have been presented .Various acoustic parameters like acoustic impedance( Z), adiabatic Compressibility ($\beta$), inter molecular free length ($L_f$), relative association ($R_a$ ) , viscous relaxation time ($\tau$), solvation number ($S_n$), absorption coefficient $\left(\alpha/f^2\right)$, rheochor, free volume ($V_f$) , surface area per mol (Y), Van der waals constant ‘a’ and 'b' , molecular radius , collision factor , available volume (Va), geometrical volume(B), internal pressure( $\pi_i$), solubility parameter,

cohesive energy density (CED), apparent molar compressibility ($\phi_K^o$), heat of vapourization ($\Delta$Hv) have been computed. Free length theory, Collision factor theory and the recent hole theory were applied for the interpretations. The values of apparent molar compressibility, solvation number, internal pressure and intermolecular free length of glycine are well comparable with the literature values.

**3(b) Viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of nickel sulphate at different temperatures and compositions**

We report here, the sound velocities and viscosities of a mixture of glycine and Nickel sulphate in 5.0%, 10.0% and 20% (v/v) aqueous methanol and acetonitrile solutions at 293 K to 318 K, measured with Ultrasonic interferometer and Ostwald's type viscometer, respectively. From these data, partial molar adiabatic compressibilities at infinite dilution ($\phi_K^o$ ), corresponding transfer compressibilities ($\Delta_{trfr}\phi_K^o$ ) and viscosity B-coefficients have been obtained. Group contributions in amino acids can be calculated from the B-coefficient data and partial molar volume data. The hydration numbers[11] and interaction coefficients have also been calculated. The transition state theory has been applied to calculate activation parameters. These results have been discussed in terms of various interactions operating in these systems.

**Chapter-4 An Ultrasonic and viscosity Studies on the Influence of Solvation of glycine and zinc sulphate in aqueous solutions of methanol and acetonitrile at different temperatures**

This chapter has been discussed under two sections

**Part A**: deals with Acoustic studies of glycine and zinc sulphate ($ZnSO_4$. $7H_2O$) at 293, 303,313 and 318K. in aqueous solutions of methanol and acetonitrile

**Part B:** deals with viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of nickel sulphate ($ZnSO_4$. $7H_2O$) at 293, 303,313 and 318K.

**4(a) Acoustic studies of glycine in aqueous and partially aqueous solutions of zinc sulphate ($ZnSO_4$. 7 $H_2O$) at 293, 303,313 and 318K**

In this section, the results obtained during the acoustic studies of a mixture of zinc sulphate in glycine solutions at various compositions ranging from (0.005 M to 0.05 M zinc sulphate solutions in 0.05 M to 0.45 M glycine solutions ) in water , 5% , 10% , 20% methanol and 5% ,10% , 20% Acetonitrile in the temperature range of 293 K to 318 K have been presented .Various acoustic parameters like acoustic impedance( Z), adiabatic Compressibility ($\beta$), inter molecular free length ($L_f$), relative association ($R_a$ ) , viscous relaxation time ($\tau$), solvation number ($S_n$), absorption coefficient $\left(\alpha/f^2\right)$, rheochor, free volume ($V_f$) , surface area per mol (Y), Van der waals constant ‘a’ and 'b' , molecular radius , collision factor , available

volume ($V_a$), geometrical volume(B), internal pressure ( $\pi_i$), solubility parameter, cohesive energy density (CED), apparent molar compressibility ($\phi_K^o$), heat of vapourization ($\Delta Hv$) have been computed.Free length theory , Collision factor theory and the recent hole theory were applied for the interpretations . Ultrasonic investigation in aqueous solutions of zinc sulphate solutions with glycine provide useful information in understanding the behaviour of liquid systems, because of intra and inter molecular association, complex formation and related structural changes which affect the compressibility of the system , which produces corresponding variations in the ultrasonic velocity[1] [9]

**4(b) Viscosity, volumetric and compressibility studies of glycine in aqueous and partially aqueous solutions of zinc sulphate at different temperatures and compositions**

We report here, the sound velocities and viscosities of a mixture of glycine and zinc sulphate in 5.0%, 10.0% and 20% (v/v) aqueous methanol and acetonitrile solutions at 293 K to 318 K, measured with Ultrasonic interferometer and Ostwald's type viscometer, respectively. From these data, partial molar adiabatic compressibilities at infinite dilution ($\phi_K^o$ ), corresponding transfer compressibilities ($\Delta_{trfr}\phi_K^o$ ) and viscosity B-coefficients have been obtained. Group contributions in amino acids can be calculated from the B-coefficient data and partial molar volume data. The hydration numbers and interaction coefficients have also been calculated. The transition state

theory has been applied to calculate activation parameters of viscous flow of amino acids in aqueous methanol and acetonitrile solutions. These results have been discussed in terms of various interactions operating in these systems.

Limiting partial molar expansibilities $\phi_E^0$ of amino acids in aqueous solutions of zinc Sulphate are calculated from the measured quantities. In the case of glycine, the transfer volume $\Delta V_\phi^o$ values are positive (except at lower concentrations of zinc Sulphate and at lower temperatures), indicating the dominance of charged end groups, $NH_3^+$ and $COO^-$. Also, group contributions are calculated for glycine in presence of aqueous and partially aqueous zinc sulphate solutions using $V_\phi^o$ values. This suggests increase in hydrophilic–hydrophobic group interactions with increase of the side-chain length of the amino acids in comparision with other amino acids.

**Chapter -5 An Introduction on conductometric calculations of electrolytes in aqueous solutions and partially aqueous solutions.**

This chapter gives an introduction to electrical conductivity, related theory, measurement and factors affecting it along with the choice of equations for the analysis of conductance data.

According to Shedlovsky method [12], the association constant for the self association of an ion in solution can be evaluated by the following equation.

$$\frac{1}{S\lambda_m} = \frac{1}{\lambda_m^0} + \frac{C\lambda_m S f_{\pm}^2 K_a}{\left(\lambda_m^0\right)^2} \quad \text{.....5.26}$$

$$\text{where} \quad S = \left[ \frac{\beta \sqrt{C\lambda_m}}{2\lambda_m^{0\ 3/2}} + \sqrt{1 + \frac{\beta^2 C\lambda_m}{4\lambda_m^{0^3}}} \right]^2 \quad \text{.....5.26}(a)$$

and

$$\beta = \frac{8.204 \times 10^5\ \lambda_m^0}{\left(\varepsilon T\right)^{3/2}} + \frac{82.5}{\eta\left(\varepsilon T\right)^{1/2}} \quad \text{.....5.26}(b)$$

$$\log f_{\pm} = \frac{-1.8246 \times 10^6 \left(C\alpha\right)^{1/2} / \left(\varepsilon T\right)^{3/2}}{1 + 50.24 \times 10^8\ R\left(C\alpha\right)^{1/2} / \left(\varepsilon T\right)^{1/2}} \quad \text{.....5.26}(c)$$

$$\alpha = \frac{S\lambda_m}{\lambda_m^0} \qquad \text{and } R = q = \frac{e^2}{2\varepsilon kT} \quad \text{.....5.26(d)}$$

where $f_{\pm}$ is the mean activity coefficient, estimated from the extended Debye- Huckel equation.

## Chapter-6 Studies on the Ion Solvent interaction of glycine, its derivatives and lysine HCl conductometrically as a function of Dielectric Constant and Temperature

This chapter has been discussed under two sections

**Part A**: deals with Ion Solvent interaction of glycine, its derivatives acetyl glycine and benzoyl glycine conductometrically as a function of Dielectric Constant at 293, 303,313 and 318K. in aqueous solutions of methanol and acetonitrile

**Part B:** deals with Ion Solvent interaction of lysine HCl conductometrically as a function of Dielectric Constant at 293, 303,313 and 318K. in aqueous solutions of methanol, acetonitrile and DMF

### 6(a) Conductometric studies of glycine and derivatives in aqueous solutions of methanol and acetonitrile

In this section , we discuss about the results of studies on the conductivity of glycine ,acetyl glycine and benzoyl glycine in water and different composition of water+ methanol/ acetonitrile at at temperature range 293 to 318K. Measurements were made on basis of electrical conductivity principle. Experimentally obtained specific conductance data were analyzed by Kraus-Bray[13] and by Shedlovsky model of conductivity to obtain limiting molar conductivity value at infinite dilution, dissociation and association constant, Walden product and corrected Stoke's radius values of the species. Thermodynamics of solvation based on Born model [14]was

studied to investigate the exothermic and endothermic nature of solvation . Thermodynamic parameters of solvation of the species such as free energy, enthalpy and entropy are evaluated and reported.ion pair formation '$K_P$' and triple ion pair formation constant '$K_T$' were determined from Fuoss-Acascina equation[15]. A comparative study of solvation behaviour of glycine with acetyl glycine and benzoyl glycine has been done. In the light of these, the existence of ion-pair/complexes i.e., ion-ion and ion-solvent interactions in the present system has been identified.

The molar conductance obtained in both the cases of electrolytes at varying compositions of water + MeOH and acetonitrile, (both 5%, 10% and 20% v/v) in temperature range 293-318K have been analysed first by Debye-Huckel-Onsager equation ;

$$\lambda_m = \lambda_m^0 - \left(A + B\lambda_m^0\right)\sqrt{C} \quad \text{.....} \qquad 6.2$$

*where,*

$$A = \frac{82.4}{\left(\varepsilon T\right)^{1/2}\eta} \quad \textit{and} \quad B = \frac{8.2\times10^5}{\left(\varepsilon T\right)^{3/2}}$$

C is the concentration in moldm$^{-3}$

$\varepsilon$ is the di electric constant

$\eta$ is the viscosity coefficient of the solvent

T is absolute temperature

The free energy ($G_{s-s}$), enthalpy ($H_{s-s}$) and entropy ($S_{s-s}$) of solute-solvent interaction resulting from the transfer of a species from one media to another i.e., vacuum /gas phase into solution or from one solvent to another is calculated using Born equation and results obtained for all the cases are given.

**6 (b) Conductometric studies of lysine HCl in aqueous solutions of methanol acetonitrile and DMF.**

In thios section , we report the results of studies on the conductivity of lysine HCl in water and different composition of water+ methanol/ acetonitrile/ DMF at temperature range 293 to 318K. Measurements were made on basis of electrical conductivity principle. Experimentally obtained specific conductance data were analyzed by Kraus-Bray and by Shedlovsky model of conductivity to obtain limiting molar conductivity value at infinite dilution, dissociation and association constant, Walden product[16] and corrected Stoke's radius values of the species. Thermodynamics of solvation based on Born model was studied to investigate the exothermic and endothermic nature of solvation.

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## List of publications/presentations

*** National conference on recent advances in chemical and environmental sciences [IYC- 2011]**

# Transport behaviour of glycine in aqueous solutions of copper sulphate in 5% to 20% methanol and acetonitrile at different temperatures

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Amino acids are the monomer units of protein molecule having an important role in all biological systems. Glycine, the simplest of all amino acids is a low molecular weight compound extensively used as a model to understand hydration behaviour of more complex molecules like proteins. Volumetric properties of solute molecules can furnish useful information about solute- solute and solute - solvent interactions pertaining to protein unfolding and extent of hydrophobic interactions of non polar side chain and differential affinities of amino acids. In the present investigation, we carried out transport behavioural studies of glycine in presence of copper sulphate as aqueous mixture with water, water- methanol, water-acetonitrile which is a prerequisite for understanding the behaviour of proteins-metal ions in biofluids. Densities and viscosities of glycine have been measured at 293K, 303K, 313K and 318 K in aqueous copper sulphate solutions of 5% to 20% methanol and 5% to 20% acetonitrile ranging from 0.005 to 0.05 molar concentrations. The viscosity data have been analyzed using the Jones- Dole equation. Apparent molar volume, limiting partial molar volume and relative viscosity have been evaluated from the density and viscosity data. The transfer volume, limiting partial expansibilities and apparent molar compressibility of glycine in aqueous copper sulphate solution have been determined from the temperature dependence of limiting partial molar volumes. The results have also been discussed using Feakin's transition state theory, in terms of structural changes in solutions. The studies have indicated the structure breaking effect of glycine in high concentration of copper sulphate solutions at high temperature. Thermodynamic parameters indicates for all concentration range of glycine , the formation of transition state is associated with bond making and results in an increase in the order

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Key words: transport behaviour – glycine-copper sulphate- Jones-Dole equation- Feakin's transition state theory- limiting partial molar volume- structure breaking effect- solute - solvent interactions

# Ion solvation studies of lysine HCl in water, methanol, acetonitrile and their mixture by conductometry

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Transport property of the species of lysine HCl has been studied in water, acetonitrile methanol and varying compositions of water – acetonitrile, water – methanol and their data has been analysed by different conductivity models to identify the involvement of association process in the system. Limiting conductivity has been found to be maximum in methanol and minimum in the case of acetonitrile indicating the preferential association of cation . Association constant has been identified at all temperature and compositions. Thermodynamic parameters have been estimated in all cases. Viscosity of various solvent and solvent mixtures have been determined and used to compute Walden's product from which stokes molecular radius is estimated. The ion-solvent and solvent – solvent interactions involved in the system have been quantitatively discussed.

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**Key words**: conductometry – lysine HCl –water- methanol-acetonitrile- Walden's product -ion- solvent - solvent interactions.

# Ion solvation studies of Glycine in water, methanol and acetonitrile by conductometry

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The specific ionic conductance of glycine in (5,10 and 20% (V/V)) methanol -water, acetonitrtrile –water mixtures at different temperatures (293, 303 ,313 and 318 K) was measured. The molar conductance[1] ($\Lambda$), limiting molar conductance ($\Lambda_0$), limiting ionic conductance ($\lambda_0$), Association constants ($K_A$), the activation energy of the transport process (Ea), Walden product ($\Lambda_0\eta_0$), hydro dynamic radii $(1/r_s^{+}+1/r_s^{-})-1$, , Standard thermodynamic parameters of association ($\Delta G_A$, $\Delta H_A$ and $\Delta S_A$) were calculated and discussed. Transport property of glycine has been studied in water, acetonitrile ,methanol and varying compositions of water – acetonitrile, water – methanol and their data has been analysed by different conductivity models[2,3] to identify the involvement of association process in the system. Limiting conductivity has been found to be maximum in methanol and minimum in the case of acetonitrile indicating the preferential association of di-polar ion. Association constant has been identified at all temperature and compositions. Viscosity of various solvent and solvent mixtures have been determined and used to compute Walden's product from which Stoke's molecular radius is estimated. The ion-solvent and solvent – solvent interactions involved in the system have been quantitatively discussed. The results show that, the molar conductance and the limiting molar conductance values were decreased as the relative permittivity of the solvent decreased while, the association constant increased. Also the results show that the molar conductance, the limiting molar conductance and the association constant values were increased as the temperature increased indicating that the association process is an endothermic one.

**Key words**: conductometry - glycine –water- methanol-acetonitrile- Walden's product -ion- solvent - solvent interactions-Molar conductance-Association- stokes molecular radius

# Acoustic behaviour of glycine in aqueous solutions of copper sulphate at different temperatures and compositions

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Ultrasonic investigation in aqueous solutions of transitional metal salt solutions with amino acids provide useful information in understanding the behaviour of liquid systems, because of intra and inter molecular association, complex formation and related structural changes which affect the compressibility of the system ,which produces corresponding variations in the ultrasonic velocity. The study of thermodynamic stability of native structure of proteins have proved quite challenging and still remains a subject of extensive investigation. Salt solutions have large effect on the structure and properties of proteins including their solubility, denaturation, dissociation into subunits and the activity of enzymes. Amino acids being the monomer units of proteins play a vital role in all metabolic processes. Amino acids are present as zwitter ions in aqueous solutions and have a capacity to form a complex with transition metals, water and methanol forms interesting solvents due to its hydrogen bonding nature. An attempt is made to study the transport behaviour of amino acids in different compositions of copper sulphate in aqueous solutions through ultrasonic investigation which is a non destructive method of analysis. The thermodynamic parameters have already been analysed using Feakin's transition state treatment by the same team. Hence the applicability of ultrasonic investigation on glycine with different compositions of copper sulphate forms an important basis of studies to compare the solvation behaviour of amino acids in general and also basis for comparative studies with other transitional metal salts in non aqueous medium also. The ultrasonic studies of amino acids in condensed phase is important because of its extremely low soluble nature and can give lot of insight into the interactions of amino acids with metal ions which is important for understanding the biological functioning[10].The derived parameters listed(Adiabatic compressibility βad- Intermolecular free length $L_f$,Internal pressure πi ,Solvation number,Rao's constant,Available volume,Ultrasonic absorption,Viscous relaxation time,Free volume)have been obtained to understand the solute solvent interactions.

**Key words**: Ultrasonic investigation - glycine - aqueous solutions of $CuSO_4$- adiabatic compressibility-intermolecular free length-internal pressure-structure breaking effect- solute - solvent interactions.